Development of Air Emissions Factors from Munitions Use

7 April 2004

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Outline

- Purpose and Background
- Test Program Overview
- Progress to Date
- Summary

Test Program Overview

Purpose of Testing

To provide scientifically defensible ordnance emissions data and decision-making tools to enable the Army to continue live fire training and testing

Source Category Description

- ~125 Army installations operate ranges where ordnance are used for training and testing
- Categories of munitions used include:
  - Firing Point

  Small caliber (< .50 cal)

  Medium caliber (.50 cal - 81 mm)

  Large caliber (> 81 mm)
  - Exploding Ordnance (point of impact)

    ¼ lb to 40 lb net explosive weight
  - Smokes and Pyrotechnics

One munition may have all types of emissions!

- Annual quantities of ordnance used per installation vary
- Criteria pollutant emissions vary

Test Program Overview

- No standardized emission factors from tactical ordnance use
- Defensible scientific data is necessary to defend training and testing operations
- Data can be used for potential future Army efforts such as development of sustainable ammunition
- Dispersion models need more information for accurate risk assessments
- Despite many experiments, only tactical firing delivers representative results

Characterization Process

Detailed Test Plan

EPA Review

Final Report

Publication in AP-42

Health Risk Assessments & Fact Sheets

Model Development and Validation

ARTEMIS (data repository)

SUSTAINABLE AMMO

G-3 approved priority list of items to test

Detailed Test Plans

- Coordinated with EPA (Emissions Measurement Center, RTP)
- Partial list of analytes:
  - particulates (diameter $\leq$ 10 microns)
  - particulates (diameter $\leq$ 2.5 microns)
  - toxic metals
  - volatile organic compounds
  - polycyclic aromatic hydrocarbons
  - semi-volatile organic compounds
  - energetic materials
  - carbonyls/aldehydes
  - carbon monoxide
  - oxides of nitrogen
  - sulfur dioxide
  - acid gases
  - dioxins/furans
  - hydrogen cyanide

For each target compound, the DTP specifies the sampling equipment; sampling and analysis method (EPA, NIOSH, etc.); modifications to methods, number of samples; sample procedure, location, and duration; sample holding times, measurement quality objectives, and data quality controls.

USAEC Emissions Program

Smoke and Pyrotechnics

Exploding Ordnance

Firing Point

West Desert Test Center

Emission Factor Reports

OGI, URS, Lockheed

Aberdeen Test Center

Emission Factor Reports

Lancaster, CHPPM, Battelle

CHPPM – HRA/Fact Sheets

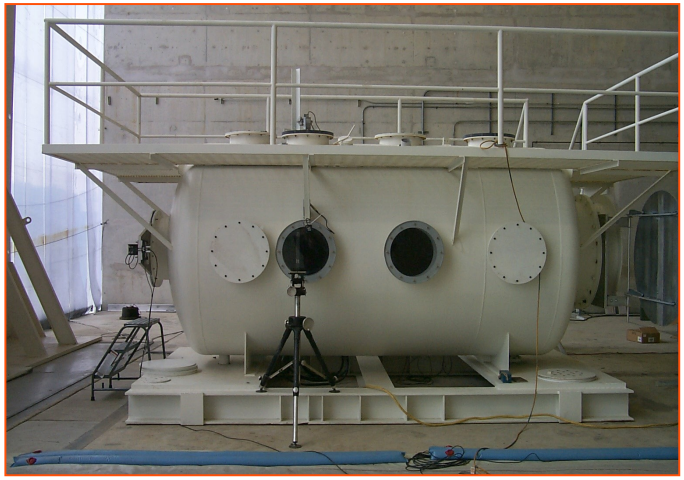
MACTEC – QA/QC

USAEC IERD - Database

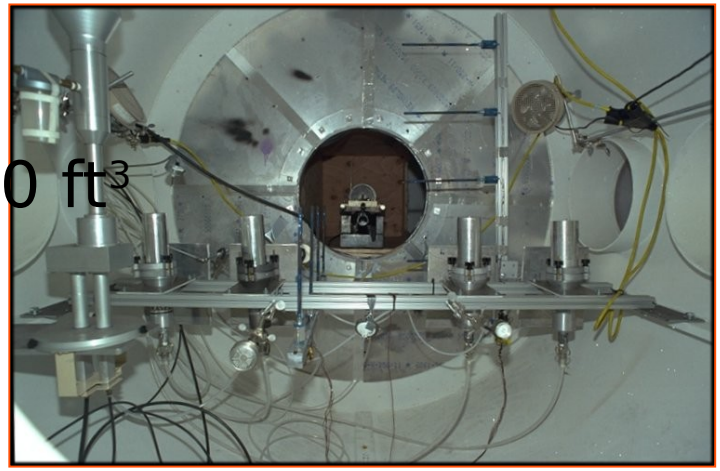
Data Review

- USAEC; Reviews for relevance and scientific accuracy (Analytical, Organic and Physical Chemists)
- ATC/DPG; Reviews for overall quality control (Chemists, Engineers and Test Directors)
- EPA; Reviews for methodology and standardization
- Contract Support; Independent auditor reviewing overall data quality and formatting
- CHPPM
- Legal
- Security
- Other Services (Air Force, Navy)

Firing Point Emissions
Small Caliber



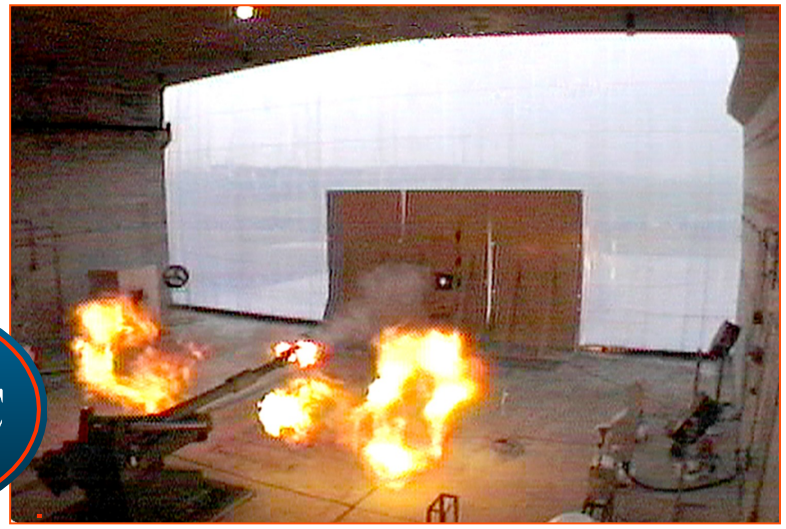
- Multiple sampling ports
- Movable gun mounts
- Sealed volume



- Adjustable volume up to 500 ft^3
- Chemically inert
- 7’ diameter X 15’ long

Firing Point Emissions
Large Caliber

- Volume ~ 186,000 ft^3
- Sealed volume
- Plastic strip door



- Steel blast shield with remotely operated firing port door
- High volume fans for rapid emissions mixing

Exploding Ordnance Emissions

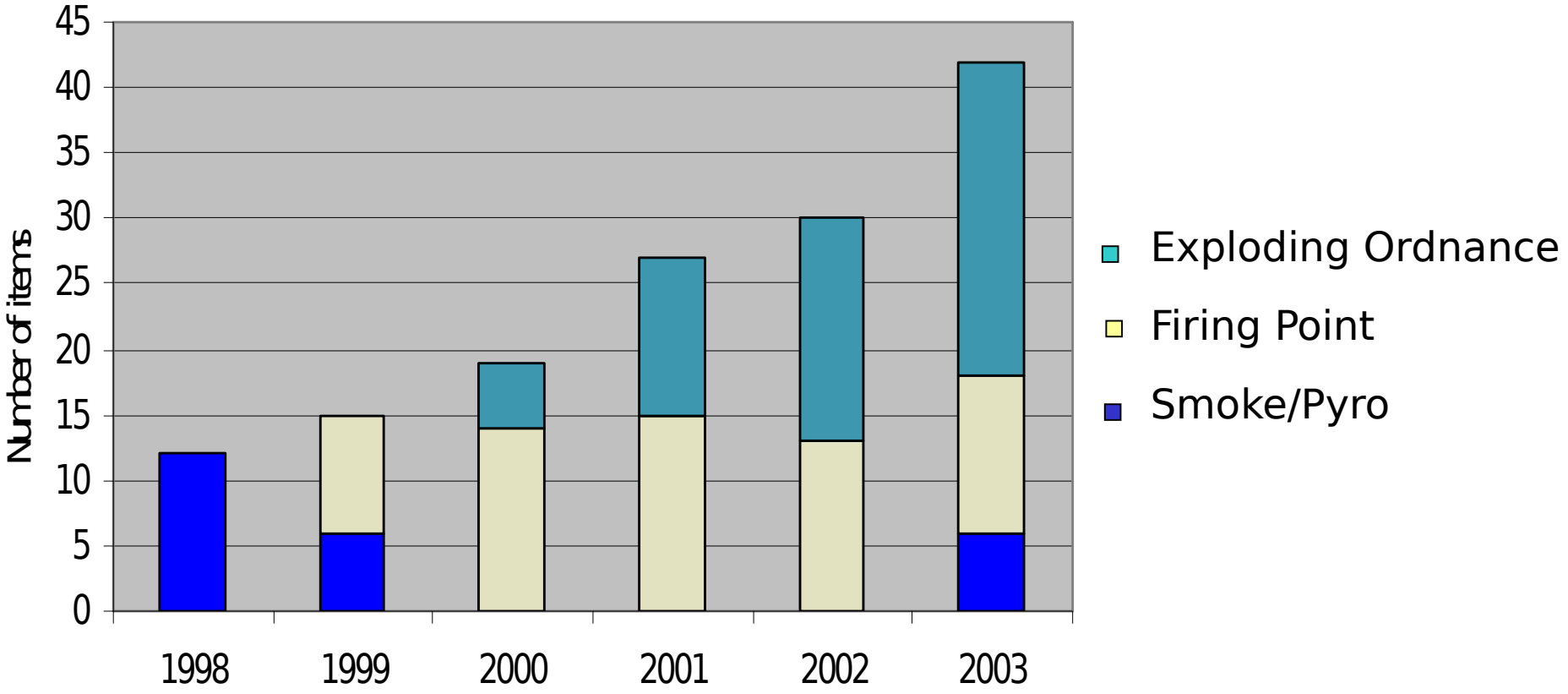
- Bang Box Facility (DPG)
- Large Octagon Test Chamber (ATC)
- Blast Sphere (ATC)

Smoke and Pyro Testing

- Designed for smoke/pyrotechnic munitions that release dyes and/or smoke
- Consists of converted refrigerator trailer
- Aluminum inner walls

Progress to Date

- 146 munitions tested to date
- 40 Health Risk Assessments and Fact Sheets available



Progress to Date

- USAEC has currently formatted 10 ordnance for publication in AP-42
  - Draft AP-42 Sections developed
  - Draft Background Information Documents developed
- Press release to be issued prior to official release to EPA
- After first 10 items, publication rate will be approximately 20 items per quarter

Example Analytes

(M195 Green Parachute Signal Flare)

Average Emission Factors

Pollutant	lb/item	lb/lb NEW*
Carbon dioxide	8.8E-02	2.8E-01
Carbon monoxide	8.9E-03	2.8E-02
Lead	4.7E-07	1.5E-06
PM10	1.2E-01	3.7E-01

Only 4 of 281 analytes shown.

*NEW = Net Explosive Weight

Regulatory Implications

- Publication of emissions factors
  - Enhances data credibility
  - Not expected to increase regulatory burden
  - Will result in more accurate (measured instead of modeled) estimates of atmospheric releases during munitions use
- Availability of this data may increase scrutiny from regulators

How the Army Uses Emissions Factors

- Installation Assistance
  - Standardized emission factors
  - Air dispersion modeling
  - Model evaluation/validation
  - Health Risk Assessments
  - Guidance on site-specific risk assessments
  - Fact Sheets
  - Emissions database
  - TRI – EPCRA
  - Health Hazard Assessments

- HQ Support
  - Outreach Tools
  - Analysis for Sustainable Ammo
  - Support Army Training and Testing Practices
  - Fate, Transport Studies

USACHPPM
Readiness thru Health

Benefits to Publishing in AP-42

- Will result in more accurate (measured instead of modeled) estimates of atmospheric releases during ordnance use
- Ensures consistency of emission factor use
- Sharing data with EPA enhances data credibility while providing greater overall quality control and improved public relations

Summary

- Defensible, scientific data are necessary to defend training and testing operations
- Data can be used for various future Army efforts such as development of sustainable ammo
- The Army is ready for publication in AP-42